

REMARKS

Claims 20-34, 45, and 46, are all the claims pending in the application. Previously, claims 1-19 and 35-44 were canceled without prejudice or disclaimer. Claims 45 and 46 have been added to further define the invention. Reconsideration and allowance of all the claims are respectfully requested in view of the following remarks.

Information Disclosure Statement (IDS)

On February 23, 2005, Applicants timely filed an IDS. Applicants respectfully request that with his next Office Action the Examiner return an initialed copy of the PTO form-1449 filed with the February 23 IDS.

Claim Objections

The Examiner objected to claim 29 as including informalities. Specifically, the Examiner questioned whether the counter counts clocks or clock pulses. Claim 29 has been amended to clarify that the counter counts clock pulses.

Claim Rejections - 35 USC § 102

The Examiner rejected claims 20-22 under §102(b) as being anticipated by US Patent 5,264,831 to Pfeiffer (hereinafter Pfeiffer). Initially, Applicants note that the Examiner has not made Pfeiffer of record. Accordingly, Applicants respectfully request that the Examiner make Pfeiffer of record by citing it on a PTO form-892 with his next Office Action. Secondly, Applicants respectfully traverse this rejection because Pfeiffer fails to disclose all of the elements as set forth and arranged in the claims.

Claim 20 sets forth a detection control circuit for detecting a consumption status of liquid contained in a liquid container by a detection device having a piezoelectric element, the detection device comprising an actually vibrating part facing a cavity which defines the vibration of the liquid. Due to the measurement of residual vibration in conjunction with the cavity, the following advantages can be achieved.

The cavity is disposed at the detection device detecting a consumption status of liquid contained in the liquid container for communicating with an interior of the liquid container and defining a vibration part. It is configured that the liquid contained in the liquid container contacts the vibrating part via the cavity. In this configuration, the detection device pinpoints its detection of the liquid consumption on a surface of the liquid contained in the liquid container, so that it can detect the consumption status of the liquid contained therein.

Defining the vibration part with the cavity not only makes the detection device capable of pinpointing the detection, but also allows the piezo element to be designed in a smaller size and, consequently, lowers the production cost of the detection device (because the piezo element is typically expensive), and also reduces an operation voltage of the piezo element. For example, in an ink cartridge used in an ink jet printer, reduction of the operation voltage becomes advantageous particularly when available voltage is limited.

Further, according to the claimed invention, as to the detection device, combining the feature of “in a detection device for detecting a consumption status of liquid contained in a liquid container ..., the detection device comprising an actually vibrating part facing a cavity which defines the vibration of the liquid” with that of “a measurement circuit segment for measuring a residual vibration of the detection device”, allows more precise detection of the residual vibration (free vibration) which may be a small amount, that may be interfered with by noise. At the time of the detection of the residual vibration, the noise takes place due to an unnecessary vibration (a different mode of vibration from the expected mode in the design) originating from errors in size and/or during assembly of a piezo electric element at the time of manufacture. However, in accordance with the claimed invention, the vibration part of the detection device is defined with the cavity, so that such unnecessary vibration can be suppressed and also there can be preformed a more precise detection of a smaller amount of the counter-electromotive voltage caused in connection with the residual vibration.

Moreover, as explained above, it is configured that the ink contained in the liquid container contacts the vibrating part via the cavity. In this configuration, the detection device detects “digitally” whether a surface of the liquid contained in the liquid container exists at a

particular position (i.e. on the cavity). As a result, even if the residual vibration is smaller, more precise detection can be performed.

In contrast to that set forth in claim 20, Pfeiffer fails to disclose an actually vibrating part facing a cavity which defines the vibration of the liquid. Instead, as shown in Fig. 3, for example, the excitation transducer 30 faces a uniform container wall 12.

For at least any of the above reasons, Pfeiffer fails to anticipate Applicants' claim 20. Likewise, this reference fails to anticipate dependent claims 21 and 22.

Allowable Subject Matter

Applicants thank the Examiner for indicating that claims 23-34 would be allowable if rewritten in independent form. Accordingly, to further prosecution of this application, Applicants have rewritten claims 23, 28, 29, 31, 32, 33, and 34, in independent form.

New Claims

New claims 45 and 46 have been added to further define the invention. Support for new claim 46 can be found, for example, in the last sentence of paragraph [0077] of the US Patent Publication 2004/56910A, which corresponds to the present application. New claims 45 and 46 depend from claim 20 and, therefore, are allowable at least by virtue of their dependency.

Conclusion

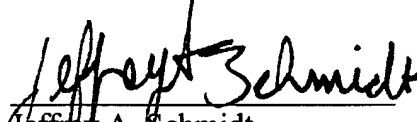
In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Amendment Under 37 C.F.R. § 1.111
US Appln. 10/662,397

Atty. Docket: Q77369

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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